DOCUMENT RESUME

ED 429 524 HE 032 019

AUTHOR	Phipps, Ronald; Merisotis, Jamie
TITLE	What's the Difference? A Review of Contemporary Research on the Effectiveness of Distance Learning in Higher Education.
INSTITUTION	Institute for Higher Education Policy, Washington, DC.
SPONS AGENCY	American Federation of Teachers, Washington, DC.; National Education Association, Washington, DC.
PUB DATE	1999-04-00
NOTE	49p.
AVAILABLE FROM	Institute for Higher Education Policy, 1320 19th St., NW, Suite 400, Washington, DC 20036; Tel: 202-861-8223; Fax: 202-861-9307; Web site: http://www.ihep.com (free).
PUB TYPE	Information Analyses (070)
EDRS PRICE	MF01/PC02 Plus Postage.
DESCRIPTORS	Access to Education; College Outcomes Assessment; *Distance Education; Educational Technology; *Higher Education; *Instructional Effectiveness; *Research Methodology; Research Needs; Student Attitudes; Teacher Attitudes; Test Reliability; Test Validity

ABSTRACT

This report presents findings of a review of the current research on the effectiveness of distance education in higher education. Major findings indicate, first, there is a paucity of truly original research dedicated to explaining or predicting phenomena related to distance learning; and, second, although most studies indicate that distance learning courses compare favorably with classroom-based instruction, the overall quality of the research is questionable and thereby renders the findings inconclusive. Key shortcomings of the research identified include: (1) much of the research does not control for extraneous variables and therefore cannot show cause and effect; (2) most of the studies do not use randomly selected subjects; (3) the validity and reliability of the instruments used to measure student outcomes and attitudes are questionable; and (4) many studies do not adequately control for the feelings and attitudes of students and faculty. Among specific research gaps identified are outcomes of complete programs rather than individual courses and reasons for high drop-out rates in distance courses. Implications drawn concern what "access to college" means, the importance of human contact in education, and the relatively limited importance of technology. Appended are an overview of the original research and other research syntheses. (Contains 70 references.) (DB)

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What's the *Difference?*

A Review of Contemporary Research on the Effectiveness of Distance Learning in Higher Education

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American Federation of Teachers

NATIONAL EDUCATION ASSOCIATION

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APRIL 1999

A Review of Contemporary Research on the Effectiveness of Distance Learning in Higher Education

PREPARED FOR:

American Federation of Teachers

nea NATIONAL EDUCATION ASSOCIATION

THE INSTITUTE FOR HIGHER EDUCATION POLICY

Acknowledgments

This report was prepared by Ronald Phipps, Senior Associate, and Jamie Merisotis, President, at The Institute for Higher Education Policy. Colleen O'Brien, Managing Director, provided editorial guidance and support. Thanks to Mark Harvey, Project Assistant, for background research and editorial support.

We also would like to thank Christine Maitland and Rachel Hendrickson in the Office of Higher Education at the National Education Association, and Larry Gold and Perry Robinson in the Higher Education Department at the American Federation of Teachers, for their outstanding feedback, comments, and advice on earlier drafts of this report. In addition, we are grateful to Free Hand Press and Cavalier Press for design, production, and printing. We heartily acknowledge the help of these individuals and recognize that they are not responsible for any errors of omission or interpretation contained herein.

For further information, please contact:

THE INSTITUTE for Higher Education Policy
1320 19th Street, NW, Suite 400
Washington, DC 20036
Tel: (202)861-8223
Fax: (202)861-9307
Web: www.ihep.com

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Foreword

Many states and institutions are experimenting with new forms of distance education—the electronic delivery of courses or entire academic programs by video and computer. States and individual colleges and universities are considering whether to make major investments in this technology. In other words, they are implicitly deciding whether to maintain or to enlarge classroom-based academic programs or to substitute electronic programs, which they believe may offer a variety of economies.

In the face of this, ordinary citizens wonder, as do educators, whether distance education may bar students from the crucial element of interchange with teachers, researchers, and other students that prepares students for a lifetime as knowledge workers. Other educators contend that distance education is just like any other form of education; it can be done well or badly.

As this report indicates, there is a good deal of research dealing with distance education. Proponents of distance education contend that the findings prove conclusively that distance learning is "as good as" traditional education if conducted properly. But when we take a closer look, is this really so? Does distance education, for example, work better for some academic subjects than others? Does it work better for some students than others? Is there more of a dropout problem with distance education? Are library and information resources sufficient under distance education? What elements are necessary for student success and have they been evaluated? Does student assessment in distance education classrooms differ from that in traditional classrooms? Is the kind of knowledge acquired the same—particularly if more than a course or two, possibly the entire academic program, is delivered at a distance? Are there administrative issues affecting quality in distance education? Are there shortcomings in the research itself?

The American Federation of Teachers and the National Education Association commissioned The Institute for Higher Education Policy to conduct a review of the current research on the effectiveness of distance education, to analyze ***what the research tells us and does not tell us***. What this report suggests is that too many of the questions posed above are left unaddressed or unanswered in the research, while policymakers, faculty, and students need to make properly informed judgements about key issues in distance education. We hope this report will lead to further research and assist with policy development in this important area.

Larry Gold
Higher Education Director
American Federation of Teachers
www.aft.org

Christine Maitland
Higher Education Coordinator
National Education Association
www.nea.org/he

Executive Summary

Distance learning is not a new phenomenon. With the development of the postal service in the 19th century, commercial correspondence colleges provided distance education to students across the country. This trend continued well into the 20th century with the advent of radio, television, and other media that allowed for learning at a distance. In the last decade, distance education has changed significantly with the use of computer-mediated learning, two-way interactive video, and a variety of other technologies. Colleges and universities are forging ahead to provide learning at a distance, and many institutions are making substantial investments in new technologies for teaching.

What impact is all of this technology having on the educational effectiveness of colleges and universities? The amount of written material devoted to distance education is extensive, and includes policy papers, "how to" articles, and essays, as well as a limited, though not insignificant body of original research. With few exceptions, the bulk of these writings suggests that the learning outcomes of students using technology at a distance are similar to the learning outcomes of students who participate in conventional classroom instruction. The attitudes and satisfaction of students using distance learning also are characterized as generally positive. Thomas Russell, in his recently published annotated bibliography entitled *The No Significant Difference Phenomenon*, lists hundreds of sources that seem to bolster these arguments. However, a closer look at the evidence suggests a more cautious view of the effectiveness of distance education.

The purpose of this analysis is to examine the research on distance learning more closely so that public policy may be better informed. What are the findings of the research on the effectiveness of distance education? Are they valid? Are there gaps in the research that

require further investigation and information? What does the literature suggest for the future? These questions are becoming more important as pressure grows—both from within and outside the academy—to use technology as a primary method for delivering higher education. To explore these issues in more detail, the American Federation of Teachers and the National Education Association commissioned The Institute for Higher Education Policy to conduct a review of the current research on distance education. Specifically, this report:

- Reviews the findings of the original research and assesses the overall quality of the analysis;
- Identifies gaps or omissions in the body of original research; and
- Discusses the implications of the research.

The scope of this review is limited to written material published during the 1990s, and particular attention is focused on those types of technologies currently being used by the majority of institutions. This paper concentrates primarily on an evaluation of the original research—including experimental, descriptive, correlational, and case studies—and summarizes the key information and findings of the other policy papers, articles, and essays that dominate the literature. While this review of original research does not encompass every study published since 1990, it does capture the most important and salient of these works.

What Does the Original Research Say About the Effectiveness of Distance Learning?

It is important to emphasize that, despite the large volume of written material concentrating on distance learning, **there is a relative paucity of true, original research dedicated to explaining or predicting phenomena related to distance learning.** From this more limited group of original research, three broad measures of the effectiveness of distance education are usually examined. These include:

- Student outcomes, such as grades and test scores;
- Student attitudes about learning through distance education; and
- Overall student satisfaction toward distance learning.

Most of these studies conclude that, regardless of the technology used, distance learning courses compare favorably with classroom-based instruction and enjoy high student satisfaction. For example, many experimental studies indicate that students participating in distance learning courses perform as well as their counterparts in a traditional classroom setting. These studies suggest that the distance learning students have similar grades or test scores, or have the same attitudes toward the course. The descriptive analysis and case studies focus on student and faculty attitudes and perceptions of distance learning. The purpose of many of these types of research is to develop recommendations to improve distance learning. These studies typically conclude that students and faculty have a positive view toward distance learning.

A closer look at the research, however, reveals that it may not be prudent to accept these findings at face value. Several problems with the conclusions reached through this research are apparent. The most significant problem is that **the overall quality of the original research is questionable and thereby renders many of the findings inconclusive.**

The findings of the original research must be read with some caution. Assessing the quality of the original research requires a determination that the studies adhered to commonly accepted principles of good research. The analysis is much more than an academic exercise. These principles are essential if the results of the studies are to be considered valid and generalizable. If a study does not abide by these principles, the results can be erroneous or misleading, and therefore lead to conclusions that result in poor public policy.

What Are the Key Shortcomings of the Research?

The analysis has found that there are several key shortcomings of the original research on the effectiveness of distance learning. These include:

- ***Much of the research does not control for extraneous variables and therefore cannot show cause and effect.***

Lack of control for extraneous variables is a major shortcoming that pertains particularly to experimental research, where the researcher attempts to compare the outcomes of a control group with the outcomes of an experimental group. Most experimental studies of distance learning are designed to measure how a specific technology—the "cause"—impacts upon some type of learning outcome or influences the attitudes of the course by

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students—the "effect." To accurately assess this relationship, other potential "causes" must not influence the measured outcomes. In almost all of the experimental research reviewed for this paper, there was inadequate control of extraneous variables.

▶ ***Most of the studies do not use randomly selected subjects.***

The single best way of controlling for extraneous variables is to assign students randomly to both the experimental and control groups. However, many of the published studies reviewed used intact groups for comparison purposes. As a result, these studies run the risk of having a number of variables affecting academic achievement or student satisfaction, not just the technology used to provide the education at a distance.

▶ ***The validity and reliability of the instruments used to measure student outcomes and attitudes are questionable.***

An important component of good educational research relates to proper measurement of learning outcomes and/or student attitudes. In short, do the instruments—such as final examinations, quizzes, questionnaires, or attitude scales—measure what they are supposed to measure? A well-conducted study would include the validity and reliability of the instruments so that the reader can have confidence in the results. In almost all of the studies reviewed, this information was lacking.

▶ ***Many studies do not adequately control for the feelings and attitudes of the students and faculty—what the educational research refers to as "reactive effects."***

Reactive effects are a number of factors associated with the way in which a study is conducted and the feelings and attitudes of the students involved. One reactive effect is known as the *Novelty Effect*, and refers to increased interest, motivation, or participation on the part of students simply because they are doing something different, not better *per se*. Another, called the *John Henry Effect*, refers to control groups or their teachers feeling threatened or challenged by being in competition with a new program or approach and, as a result, outdoing themselves and performing well beyond what would normally be expected. In many studies, precautions were not taken in the research to guard against these effects.

What Are the Gaps in the Research That Require Further Investigation and Information?

Notwithstanding the fact that the overall quality of the research needs improvement, there are several important issues regarding the effectiveness of distance learning that require further investigation and information. These gaps must be filled so that public policy discussions are based on accurate and adequate information. Specific issues include:

A. The research has tended to emphasize student outcomes for individual courses rather than for a total academic program.

A major gap in the research is the lack of studies dedicated to measuring the effectiveness of total academic programs taught using distance learning. Virtually all of the comparative or descriptive studies focus upon individual courses. This raises important questions about whether a total academic program delivered by technology compares favorably with a program provided on campus. In addition to cognitive skills, and verbal, quantitative, and subject matter competence, outcomes with regard to critical thinking skills, attitudes and values, moral development, etc. need to be addressed.

B. The research does not take into account differences among students.

A substantial portion of research on distance learning has been conducted to demonstrate no significant difference in achievement levels between *groups* of distance and traditional learners. However, there is wide variance of achievement and attitudes within the groups, which indicates that learners have a variety of different characteristics. The factors influencing these differences could include gender, age, educational experience, motivation, and others. Gathering samples of students and amalgamating them into averages produces an illusory "typical learner," which masks the enormous variability of the student population. Further research needs to focus on how individuals learn, rather than how groups learn.

C. The research does not adequately explain why the drop-out rates of distance learners are higher.

In a number of studies, there was evidence that a higher percentage of students participating in a distance learning course tended to drop out before the course was completed compared to students in a conventional classroom. The issue of student persistence is troubling because of both the negative consequences associated with dropping out, and

the fact that the research could be excluding these dropouts—thereby tilting the student outcome findings toward those who are "successful."

D. The research does not take into consideration how the different learning styles of students relate to the use of particular technologies.

Understanding of how the learner, the learning task, and a particular technology interact is limited. Learner characteristics are a major factor in the achievement and satisfaction levels of the distance learner. Information regarding a student's preferred learning style will influence how the course is designed and the type of technology to be used. Additional research could result in more information regarding why different technologies might be better suited for specific learning tasks.

E. The research focuses mostly on the impact of individual technologies rather than on the interaction of multiple technologies.

Much of the literature on distance learning focuses on one technology and either describes its effectiveness and/or compares it to the conventional classroom experience. Most technologies, however, are multifunctional and can be adapted to address a wide range of learning outcomes. Unfortunately, there are few studies that examine more than one technology—and the synergistic effects of certain technologies—in addressing specific educational outcomes and student groups. The few studies that are available do not provide ample grounds for generalization because of a range of limitations, including small sample sizes and lack of sufficient explanation of the instructional treatment.

F. The research does not include a theoretical or conceptual framework.

There is a vital need to develop a more integrated, coherent, and sophisticated program of research on distance learning that is based on theory. Theory allows researchers to build on the work of others and, therefore, increase the probability of addressing the more significant questions regarding distance learning. Using theory as a guiding framework also allows the research to be replicated and enhances its generalizability, making individual studies more meaningful.

G. The research does not adequately address the effectiveness of digital "libraries."

Students participating in distance learning, particularly those in remote locations, are often introduced to a digital "library" that provides access to bibliographies, as well as full-

text, of a variety of resources. The library is at the core of the higher education experience and, especially at the graduate level, is an integral part of the teaching/learning process. Some digital libraries boast an enormous array of resources, with the implicit notion that they can provide the same service as the traditional library. But do digital libraries provide adequate services for the academic programs they are established to support? Anecdotal evidence seems to suggest that the curriculum objectives of some distance learning courses have been altered because of a limited variety of books and journals available from the digital library.

Implications

Research on distance learning has been driven by what many are calling the "information revolution." Advances in technology offer both the general public and faculty a dizzying array of challenges that are unprecedented. Technology is having, and will continue to have, a profound impact on colleges and universities in America and around the globe. Distance learning, which was once a poor and often unwelcome stepchild within the academic community, is becoming increasingly more visible as a part of the higher education family. But the research and literature reviewed for this paper indicate that the higher education community has a lot to learn regarding how, and in what ways, technology can enhance the teaching/learning process, particularly at a distance.

There are at least three broad implications that can be derived from this review of the original research and the other literature. The first is that the notion of "access to college" in the distance learning context is unclear. Many of the advocates of distance learning tout access to college-level education as a *raison d'etre* for the proliferation of distance education. Indeed, in some states, public policy leaders are recommending using distance education in lieu of "bricks and mortar" learning. Of particular concern is access as it relates to the efficacy of computer-mediated learning. Unlike two-way interactive video, where students and the instructor can see and talk to each other in a conventional classroom, computer-mediated learning requires special skills of students and more sophisticated technical support if students are to interact fully. Questions that need to be asked include: What is the "quality" of the access? Does the student have the necessary skills to use the technology? What are the best ways to participate in asynchronous communication? Is there adequate technical support? Perhaps most important, will the cost of purchasing a computer and maintaining software be prohibitive for a substantial number of students?

Second, it seems clear that technology cannot replace the human factor in higher education. Faculty involved in distance education find themselves being a combination of content experts, learning process design experts, process implementation managers, motivators, mentors, and interpreters. In short, technology "can leverage faculty time, but it cannot replace most human contact without significant quality losses," as one expert has stated.

Third, although the ostensible purpose of much of the research is to ascertain how technology affects student learning and student satisfaction, many of the results seem to indicate that technology is not nearly as important as other factors, such as learning tasks, learner characteristics, student motivation, and the instructor. The irony is that the bulk of the research on technology ends up addressing an activity that is fundamental to the academy, namely pedagogy—the art of teaching. To that extent, the research has had a salutary effect in that a rising tide lifts all boats. Any discussion about enhancing the teaching/learning process through technology also has the beneficial effect of improving how students are taught on campus.

In a sense, the discussion has come full circle. The research on distance learning has a long way to go, and much of it is inconclusive. On the other hand, technology has helped the academy to continue its focus on the essential goals of teaching and learning. As a result, either implicitly or explicitly, the key question that needs to be asked is: What is the best way to teach students?

Introduction

Distance learning is not a new phenomenon. With the development of the postal service in the 19th century, commercial correspondence colleges provided distance education to students across the country. This trend continued well into the 20th century with the advent of radio, television, and other media that allowed for learning at a distance. In the last decade, providing education at a distance has changed significantly as the use of computer-mediated learning, two-way interactive video, and other technologies has increased. Many universities are making substantial investments in new technologies for teaching.

What impact is all of this technology having on the educational effectiveness of colleges and universities? William Wulf, professor of engineering and applied science at the University of Virginia, makes the following observation about this issue:

> "Universities are in the information business, and technological developments are transforming that industry. University professors from a variety of disciplines have helped create the technologies that are forcing many U.S. industries to reinvent themselves, have advised industry leaders on how to adapt, and have analyzed the importance of changes for society. But it is harder to look inward to the university and to think about whether it might change in dramatic ways."[1]

In recent years, colleges and universities have spent a great deal of time and effort in looking inward to analyze the efficacy of learning through the use of technology. This includes policy papers, "how to" articles, and essays, as well as a limited, though not insignificant body of original research. With few exceptions, the bulk of these writings suggests that the learning outcomes of students using technology at a distance are similar to the learning

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outcomes of students who participate in conventional classroom instruction. The attitudes and satisfaction of students using distance learning also are characterized as generally positive. Indeed, Thomas Russell's recently published annotated bibliography of papers, articles, and research studies about the effectiveness of distance learning, entitled *The No Significant Difference Phenomenon*, lists 355 sources dating back as early as 1928 that seem to bolster these arguments.[7] However, a closer look at the evidence suggests a more cautious view of the effectiveness of distance education.

In the last decade, providing education at a distance has changed significantly as the use of computer-mediated learning, two-way interactive video, and other technologies has increased.

There is no question that there is an impressive amount of writing that concludes that distance learning is viable and effective. The purpose of this analysis is to examine the research more closely so that public policy may be better informed. What are the findings of the research on the effectiveness of distance education? Are they valid? Are there gaps in the research that require further investigation and information? What does the literature suggest for the future? These questions are becoming more and more important as pressure grows—both from within and outside the academy—to use technology as a primary method for delivering higher education. To explore these issues in more detail, the American Federation of Teachers and the National Education Association commissioned The Institute for Higher Education Policy to conduct a review of the research on distance education.

This report is designed to take an objective look at the research to help answer these questions. Specifically, the report:

- Reviews the findings of the original research and assesses the overall quality of the analysis;
- Identifies gaps or omissions in the body of original research; and
- Discusses the implications of the research.

In addition, the appendices include a description of the range and variety of studies conducted, along with a summary of the content of articles found in major distance education publications, the vast majority of which are not original research studies.

Because of the large amount of information available, the scope of this review is limited to written material published during the 1990s. Particular attention is focused on those types

of technologies currently being used by the majority of institutions, as identified in a 1997 study by the National Center for Education Statistics (NCES). They include two-way interactive video, one-way prerecorded video, two-way audio/one-way video, and computer-mediated learning.[3]

It is important to understand what is meant by "distance learning." Because the technology is evolving, the definition of what distance learning is continues to change. Distance learning generally includes "synchronous communication," which occurs when teacher and student are present at the same time during instruction—even if they are in two different places—and "asynchronous communication," which occurs when students and teachers do not have person-to-person direct interaction at the same time or place. According to a recent report by the Council for Higher Education Accreditation, distance learning also is characterized by several key factors. Among the most important are that the teaching-learning process involves activities where the learners are at a distance from the originator of the teaching material, and that a combination of media—including television, videotapes, audiotapes, videoconferencing, audioconferencing, e-mail, telephone, fax, Internet, computer software, and print—may be used.[4]

What are the findings of the research on the effectiveness of distance education? Are they valid? Are there gaps in the research that require further investigation and information?

Analytic Approach

While this review of original research does not encompass every study published since 1990, it does capture the most important and salient of these works. The analysis includes over 40 of these original works of research. In addition, several hundred articles, essays, and other writings published in major journals on distance learning have been collected. These other essays, narratives, and reviews of older research are helpful, but do not provide sufficient evidence to accurately assess the effectiveness of distance learning. This paper therefore concentrates primarily on an evaluation of the original research, and summarizes the key information and findings of the non-original research writings.

The original research utilizes various approaches, including: descriptive research; case studies; correlational research; and experimental research.[5] The overwhelming majority of research studies used one or more of these types of designs. (See page 12 for descriptions of each of these approaches.)

Research Approaches

Descriptive research involves the collection of data to answer specific questions. Data are usually collected through questionnaires, interviews, or standardized attitude scales. An important component of descriptive research is the validation of the questionnaire in order to determine if it measures what it was developed to measure. Data also can be collected through observation, for instance, analyzing student grades. In distance learning, typical descriptive studies are concerned with the assessment of attitudes, opinions, and conditions.

A ***case study*** is an in-depth investigation of one "unit." The researcher can use a variety of methods to gather data, however, the explanation of the unit is generally written in narrative form. In distance learning, the case study usually involves a class of students taking a course through some type of electronic means.

Correlational research involves collecting data in order to determine whether, and to what degree, a relationship exists between two or more quantifiable variables. An estimate is provided of just how related two variables are. If two variables are highly related, a correlation coefficient near +1.00 (or -1.00) will be obtained; if two variables are not related, a coefficient near .00 will be obtained. It is important to note that correlational research never establishes a cause-effect relationship. One example of a correlational study might be determining the relationship (correlation) between student satisfaction with an instructor and the type of technology used.

Experimental research is the only type of research that can truly test hypotheses concerning cause- and-effect relationships. In an experimental study, the researcher manipulates at least one independent variable and observes the effect on one or more dependent variables. In other words, the researcher determines "who gets what," which group of subjects will get which treatment. The groups are generally referred to as experimental and control groups. Ideally, in experimental research the groups to be studied are randomly formed before the experiment, a procedure not involved in other methods of research. The essence of experimentation is the notion of "control." The researcher strives to insure that the experiences of the groups are as equal as possible on all important variables except the independent variable. In a study of distance education, a good example is comparing one group of students receiving instruction in a traditional classroom (the control group) with another group of students receiving instruction through two-way interactive video (the experimental group).

What Does the Original Research Say About the Effectiveness of Distance Learning?

It should be emphasized that the review provided striking evidence of the fact that there is a relative paucity of true, original research dedicated to explaining or predicting phenomena related to distance learning. The more limited group of original research on the effectiveness of distance learning addresses a variety of issues. Three broad measures of the effectiveness of distance education are usually examined in the original research. These include:

- Student outcomes, such as grades and test scores;
- Student attitudes about learning through distance education; and
- Overall student satisfaction toward distance learning.

Most of these studies conclude that, regardless of the technology used, distance learning courses compare favorably with classroom-based instruction and enjoy high student satisfaction. Several examples illustrate this point. One study compared student grades and attitudes at the sending site for several two-way interactive video courses with student grades and attitudes at the receiving site. The courses included education, nursing, and philosophy. Students at the receiving site attained lower grades than the students at the sending site. On the other hand, receiving site students in general portrayed a more positive attitude than sending site students.[6] Another study compared the results of a take-home essay exam for students who participated in a live broadcast televised graduate course in management of technology with the results for students in the on-campus classroom. The students participating in distance learning performed better than students in the conventional classroom and had less inter-student variation. Term papers for the groups

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also were compared and no significant difference was found. With respect to homework, the distance learning students performed at a higher level.[7]

At the high school level, a study compared the attitudes and achievements scores of students participating in an anatomy and physiology course taught in a regular classroom and delivered through interactive satellite. No significant differences were found between the attitudes of either group toward the courses. However, the group taught via satellite had higher mean scores on an achievement test than students in the classroom.[8]

In one study, students who registered for a Sociology 101 course on campus were told that the course instead would be taught by a one-way televised broadcast. The group's performance with respect to attrition and grades was then compared to another group of students from the community who took the same course, also via one-way televised broadcast, but in their homes, not in a classroom on campus. Both sections experienced a high percentage of students who did not complete the course (44 percent of the on-campus students, and 33 percent of the "off-campus" students). The off-campus students had much higher grades than the on-campus students, although both groups rated the course as good or excellent. A higher proportion of on-campus students reported that they would not recommend the telecourse to a friend.[9]

It should be emphasized that the review provided striking evidence of the fact that there is a relative paucity of true, original research dedicated to explaining or predicting phenomena related to distance learning.

Another study compared three groups of teachers participating in an in-service microcomputer applications training course: one group was taught by computer-mediated learning, another group of teachers was taught on campus, and yet another group was taught through correspondence. The outcomes measured included scores on achievement tests, time-on-task, student attitudes, and drop-out rates. While the results were mixed, the scores on achievement tests were highest for students taking a correspondence course and lowest for students participating in computer-mediated learning. The computer-mediated learning and correspondence students spent more time-on-task than the on-campus students. Furthermore, there was a significant difference in the attitudes of students; the computer-mediated learning group was less positive toward the course than the conventional classroom group.[10]

These examples of experimental research are consistent with many other studies that indicate students participating in distance learning courses perform as well as their counterparts in a traditional classroom setting. As Russell notes, merely because the research suggests that there is no difference in student performance does not mean that distance learning is necessarily *better* than other methods of learning, just that it can be as effective.[11]

There is also a body of descriptive analysis and case studies that focuses on student and faculty attitudes and perceptions of distance learning. The purpose of many of these types of research is to develop recommendations to improve distance learning. One such study examined the perceptions and attitudes of students and faculty toward computer-mediated learning and courses broadcast over a local television channel. A majority of faculty observed that the distance learning students were "more serious, accomplished, and articulate" compared to on-campus students. The distance learning students also had stronger analytical skills and written communication skills, and were more "self-directed" than their on-campus counterparts. The students reported that they chose distance education because of the flexible schedule, and nearly half of the students noted that the instructional method also influenced their decision. Students preferred not to commute and "enjoyed the luxury of not having to commit to a specific class meeting time." Approximately 40 percent of the students reported missing the face-to-face interactions and one-fourth missed the group dynamics. One of the major recommendations of this study was to "explore alternative ways to meet students' interaction needs" on a continuous basis.[12]

These studies suggest that the distance learning students have similar grades or test scores, or have the same attitudes toward the course.

Several conclusions can be drawn from research that examined courses offered to U.S. Army and Navy personnel through two-way interactive video. These conclusions include: the choice of technology influences the instructional design; origination and remote site technicians are crucial; adequate training for staff is necessary; sufficient practice and technical support are necessary because personnel are often intimidated by new technology; and activities need to be designed to allow students to interact with each other.[13]

In another descriptive study involving two-way interactive video, graduate nursing students were surveyed about their satisfaction regarding the technology. The majority of the respondents were very positive concerning distance education and requested more

distance learning opportunities. There was, however, considerable dissatisfaction with the accessibility of the library.[14] Graduate education students participated in another study to determine their perceptions of two-way interactive video courses. Using written surveys, interviews, and class observations, the authors reported very mixed reactions from the students, which resulted in several specific recommendations. In addition to recommending that the audio quality needed to be improved, it was suggested that future training programs include information on successful strategies for instruction and use more graphics. A toll-free phone number was proposed to contact the instructor.[15]

One final example from the original research is a study that attempted to identify specific student attributes associated with student success in computer-mediated learning. Student success was defined as whether newly enrolled students passed their first course using computer-mediated learning. The following student characteristics were identified as being correlated with success.

- Students who rated themselves highly on various measures of persistence related to taking on new projects;
- Married students;
- Students who rated the consequences of not passing as serious;
- Students who rated their chances of succeeding in their studies higher than non-completers;
- Students who did not need support from others to complete difficult tasks and did not find it important to discuss course work with other students;
- Students with high literacy levels;
- Students who rated themselves as well organized in terms of time management skills and said they generally had the time to do what they intended to do;
- Students who rated their formal and informal learning as high in terms of preparing them for university studies; and
- Female students.[16]

In sum, many experimental studies conclude that students participating in distance learning courses perform as well as their counterparts in a traditional classroom setting. These studies suggest that the distance learning students have similar grades or test scores, or have the same attitudes toward the course. The descriptive analysis and case studies focus on student and faculty attitudes and perceptions of distance learning. The purpose of many of these types of research is to develop recommendations to improve distance learning. These studies typically conclude that students and faculty have a positive view toward distance learning. A closer look at the research, however, reveals that it may not be prudent to accept these findings at face value.

What Are the Key Shortcomings of the Research?

Russell's annotated bibliography of papers, articles, and research studies, entitled *The No Significant Difference Phenomenon*, is often cited as evidence of the fact that the very weight of the evidence renders the general conclusion of no significant difference to be almost indisputable. However, Russell's book and web site provide a window on the problems that can be encountered in pulling together such disparate information. For example, a closer examination of the range of documents cited in the book reveals some concerns. One is that there is considerable cross-referencing, where many of the papers and summaries cite similar research and/or reference each other. This somewhat inflates the number of documents that reach the no significant difference conclusion. In addition, many of the writings cited in the volume are not original research studies. There is, we believe, no effort on the author's part to mislead readers; in fact, Russell makes it very clear that the book is a compendium of only those materials that present the case for no significant difference. Accordingly, his book has provided a valuable contribution to the literature on distance learning. However, the book does provide discerning readers with evidence that care needs to be exercised in evaluating the original research and other documents and articles.

The most important problem is that the overall quality of the original research is questionable and thereby renders many of the findings inconclusive.

In examining the more limited group of original research, several problems with the conclusions reached through the research are apparent. The most important problem is that the overall quality of the original research is questionable and thereby renders many of the findings inconclusive.

The findings of the original research must be read with some caution. Assessing the quality of the original research requires a determination that the studies adhered to commonly accepted principles of good research. The analysis is much more than an academic exercise. These principles are essential if the results of the studies are to be considered valid and generalizable. If a study does not abide by these principles, the results can be erroneous or misleading, and therefore lead to conclusions that result in poor public policy.

In almost all of the experimental research reviewed for this paper, there was inadequate control of extraneous variables.

The analysis revealed several methodological flaws that should give pause to an objective observer. This is not necessarily surprising. Merely being published in a journal or book, for example, does not guarantee the quality of the study or that it was reported accurately. For instance, in a study which involved a meta-analysis of interactive video instruction, 367 experimental or quasi-experimental studies initially were identified for consideration. However, only 63 studies (17 percent) were chosen for the analysis because the remaining studies had methodological flaws, such as small sample size, high subject mortality, or the lack of minimal data to compute effect size (including means, standard deviations, *t* test, and *F* values).[1]

Unfortunately, many of these same criticisms apply to the research reviewed for this paper. The following are the key shortcomings of the original research on the effectiveness of distance learning.

Much of the research does not control for extraneous variables and therefore cannot show cause and effect.

Lack of control for extraneous variables is a major shortcoming that pertains particularly to experimental research, where the researcher attempts to compare the outcomes of a control group with the outcomes of an experimental group. Most experimental studies of distance learning are designed to measure how a specific technology—the "cause"—impacts upon some type of learning outcome or influences the attitudes of students—the "effect." To accurately assess this relationship, other potential "causes" must not influence the measured outcomes. If other variables influence outcomes, it is impossible to attribute "cause" to the technology being used.

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In almost all of the experimental research reviewed for this paper, there was inadequate control of extraneous variables. This analysis is consistent with a 1992 inquiry of 150 articles and studies that compared distance education learning to conventional classroom instruction, which found that differences other than the technology "could not be ruled out as key causal agents."[18]

One example involves a study comparing students taking a statistics class in a traditional classroom and through computer-mediated learning. In the discussion section of the report, the author states the following:

> Therefore, from these data, I suspect much of the performance differences can be attributed to student collaboration as to the technology, itself. In fact, the highest performing students (in both classes) reported the most peer interaction. Therefore, it is important that faculty contemplating the use of the virtual format pay attention to the issue of real time collaboration, whether carried from within the traditional classroom or in the context of virtual space. This is the key variable that should be controlled in further research on the subject of virtual teaching.[19]

Most of the studies do not use randomly selected subjects.

Lack of random selection of subjects is closely aligned with control of extraneous variables, and is another major weakness in the research evaluating distance learning. The single best way of controlling for extraneous variables is to assign students randomly to both the experimental and control groups. Using the previous example, if random selection of subjects was used, it would be expected that the students would be similar with respect to motivation, experience, age, etc. However, many of the published studies reviewed used intact groups for comparison purposes. As a result, these studies run the risk of having a number of variables affecting academic achievement or student satisfaction, not just the technology used to provide education at a distance.

One important caveat: random selection does not *guarantee* that the control and experimental groups are similar in all attributes, but it is an accepted practice in good research and is considerably better than using intact groups. In addition, it should be noted that while there are statistical procedures for pretesting that can be utilized if intact groups are used, in many studies these procedures were not employed.

The validity and reliability of the instruments used to measure student outcomes and attitudes are questionable.

An important component of good educational research relates to proper measurement of learning outcomes and/or student attitudes. In short, do the instruments—such as final examinations, quizzes, questionnaires, or attitude scales—measure what they are supposed to measure? A well-conducted study would include the validity and reliability of the instruments so that the reader can have confidence in the results. In almost all of the studies reviewed, this information was lacking. Not only were the data regarding the appropriateness of the instruments absent, it was clear that the validity and reliability of the tests or questionnaires were not even determined.

Many of the published studies ...run the risk of having a number of variables affecting academic achievement or student satisfaction, not just the technology used to provide education at a distance.

In a study assessing students' initial perceptions of distance learning, the author developed a survey based upon other surveys targeting course satisfaction. There was no evidence that the survey used pilot testing or other techniques to enhance validity.[20] Many other studies involved the use of teacher produced examinations, which have not followed established methods for ensuring high levels of validity and reliability. It is rare to find a teacher-made test in the research that is based upon persuasive evidence of content or construct validity.

Many studies do not adequately control for the feelings and attitudes of the students and faculty—what the educational research refers to as "reactive effects."

Reactive effects are a number of factors associated with the way in which a study is conducted and the feelings and attitudes of the students involved. Two are worth mentioning here because they were evident in many of the studies under review. One reactive effect, known as the *Novelty Effect*, refers to increased interest, motivation, or participation on the part of students simply because they are doing something different, not better *per se*. Another, called the *John Henry Effect*, refers to control groups or their teachers feeling threatened or challenged by being in competition with a new program or approach and, as a result, outdoing themselves and performing well beyond what normally would be expected. When this effect occurs, the experimental treatment may not appear to be very effective.

The Novelty Effect in particular can be observed when distance learning is used for the first time. In one case study, the first offering of a distance learning course was investigated. Using a variety of observational methods, the attitudes of both students and faculty regarding the delivery mode and methods of instruction were ascertained. Since the students and faculty were keenly aware of this new venture, their responses needed to be analyzed with some level of reservation.[21]

Summary

A significant portion of the research reviewed possesses serious weaknesses that call into question their results. That is not to say that well-constructed research designs were not found in the literature. Indeed, studies were found that provided the reader with some confidence in the findings. Unfortunately, they were in the minority.

Moore and his colleagues make this point plainly in their review of the literature on distance learning's effectiveness:[22]

> The weight of evidence that can be gathered from the literature points overwhelmingly to the conclusion that teaching and studying at a distance, especially that which uses interactive electronic telecommunications media, is effective, when effectiveness is measured by the achievement of learning, by the attitudes of students and teachers, and by cost effectiveness.
>
> To this optimistic conclusion it is necessary to append several reservations. The sheer weight of opinion in the literature should not be taken as conclusive of itself, since most of it is based on anecdotal evidence offered by persons and institutions with vested interests in the techniques being evaluated, or in the very programs they are evaluating. Furthermore, in those studies where some attempt has been made to gather empirical data, the research has been undertaken by schoolteachers or university faculty with extremely limited resources. As a result, the methodology of many of the research designs is weak, with regard to such factors as the populations being compared or otherwise studied; the treatments being given, the statistical techniques being applied, and the validity, reliability, and generalizability of the data on which the conclusions are based.

What Are the Gaps in the Research That Require Further Investigation and Information?

Notwithstanding the fact that the overall quality of the research needs improvement, there are several important issues regarding the effectiveness of distance learning that require further investigation and information. These gaps must be filled so that public policy discussions are based on accurate and adequate information. The discussion below identifies those areas of research that either need to be strengthened or are absent from the literature.

The research has tended to emphasize student outcomes for individual courses rather than for a total academic program.

A major gap in the research is the lack of studies dedicated to measuring the effectiveness of total academic programs taught using distance learning. Virtually all of the comparative or descriptive studies focus upon individual courses. This raises important questions about whether a total program delivered by technology compares favorably with a program provided on campus. Many institutions advertise that students can complete a degree without leaving their home by participating in distance learning in a number of ways, including computer-mediated learning, receiving videotapes, or watching courses through their local cable network.

Gathering samples of students and amalgamating them into averages produces an illusory "typical learner," which masks the enormous variability of the student population.

The overall impact of a college education, particularly the baccalaureate degree, is of considerable concern to educators, the general public, and public policy leaders alike. A college education is intended to impart much more than an accumulation of facts. The seminal study *How College Affects Students*, by Pascarella and Terenzini, provides an excellent summary of the outcomes of an under-

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graduate degree.[23] In addition to certain cognitive skills and verbal, quantitative, and subject matter competence, the authors identify several other outcomes of students who complete a college degree. They include psychosocial changes, such as identity, self-concept, self-esteem, and relating to others in the external world; advancement of critical thinking skills; development of attitudes and values; moral development; and career choice and development.

To the extent that these attributes are important, an entire body of research needs to be developed to determine if students participating in distance learning for their whole program compare favorably with students taught in the conventional classroom. To be sure, researchers tend to measure what they can measure. Conducting such research would take an enormous commitment of both time and money, let alone finding an adequate sample. On the other hand, this issue strikes at the very core of what a college education is all about and the degree to which distance education students benefit.

The research does not take into account differences among students.

A substantial portion of research on distance learning has been conducted to demonstrate no significant difference in achievement levels between *groups* of distance and traditional learners. However, there is wide variance of achievement and attitudes within the groups, which indicates that learners have a variety of different characteristics. The factors influencing these differences could include gender, age, educational experience, motivation, and others. Gathering samples of students and amalgamating them into averages produces an illusory "typical learner," which masks the enormous variability of the student population.[24]

Stated more plainly, experimental studies in distance learning are using an "agricultural-botany paradigm—assuming that students react to different educational treatments as consistently as plants react to fertilizers."[25] Further research needs to focus on how individuals learn, rather than how groups learn. This is particularly important because technology has the potential to individualize learning to a greater degree than previously known.

The research does not adequately explain why the drop-out rates of distance learners are higher.

In a number of studies, there was evidence that a higher percentage of students participating in a distance learning course tended to drop out before the course was completed compared to students in a conventional classroom. For instance, in one study, while the mean pass mark was 81 percent, only 40 percent of the students successfully completed the course.[26] In another study, one-third of the students in a videoconferencing class received the grade of "I" (incomplete), compared to only 15 percent in an on-campus course.[27] In another study comparing an engineering course taught in a conventional classroom to one taught through computer-mediated learning, 95 percent of the resident students finished the course, compared to 64 percent of the computer-mediated learning students.[28] One other study found that students participating in computer-mediated learning had significantly higher incompletion rates (32 percent) than the on-campus students (4 percent).[29]

There are few studies that examine more than one technology—and the synergistic effects of certain technologies—in addressing specific educational outcomes and particular student groups.

The issue of student persistence (called subject mortality by researchers) is troubling because of both the negative consequences associated with dropping out, and the fact that the research could be excluding these dropouts—thereby tilting the student outcome findings toward those who are "successful." For example, if the average mean score of an achievement test or the score from a survey measuring student satisfaction is based upon a smaller number of students than had registered for the course, the data could be invalid. In other words, if the students who had dropped out had remained in the course, the mean score of the achievement test or student survey could be significantly different.

A major reason for providing distance education is to provide access to students who normally would not be able to participate in higher education. If a substantial number of students fail to complete their courses, the notion of access becomes meaningless. Distance learning studies should clearly indicate the beginning and ending number of students in a course to ensure that dropouts are not excluded from the analysis.

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The research does not take into consideration how the different learning styles of students relate to the use of particular technologies.

Similar to the relationship of course content and technology, understanding of how the learner, the learning task, and a particular technology interact is limited. Learner characteristics are a major factor in the achievement and satisfaction levels of the distance learner. Information regarding a student's preferred learning style will influence how the course is designed and the type of technology to be used. The development of software could be enhanced from a better understanding of the properties of technology (such as interactive and passive characteristics) with factors such as complexities of tasks, and cognitive, affective, and psychomotor skills.[10] Additional research could result in more information regarding why different technologies might be better suited for specific learning tasks.

In one study that attempted to address these issues, students were self-assigned to two groups: an on-campus conventional class, and a remote distance learning class using two-way interactive video. The students were administered the Canfield Learning Styles Inventory to ascertain each student's primary learning style. The author concluded that learning style preferences may affect academic achievement and attitudes of students participating in distance learning. However, the study has limited validity because of a small number of subjects, all of which were female.[11]

The research focuses mostly on the impact of individual technologies rather than on the interaction of multiple technologies.

Much of the literature on distance learning focuses on one technology and either describes its effectiveness and/or compares it to the conventional classroom experience. Practitioners in the field are learning that most technologies are multifunctional and can be adapted to address a wide range of learning outcomes. Using a combination of technologies is now being labeled the "third generation" of distance learning systems (the first and second being correspondence courses and the current use of single mediums, respectively). For instance, combining two-way interactive video with computer-mediated learning could prove to be a very powerful tool for learning, particularly higher order thinking skills. The third generation models often use a combination of print, videotape, audio tape, fax, audio conferencing, and voice mail. Combining these technologies with computer-mediated learning enhances interaction between student and student, and student and teacher. Unfortunately, there are few studies that examine more than one technol-

ogy—and the synergistic effects of certain technologies—in addressing specific educational outcomes and particular student groups. The few studies that are available do not provide sufficient grounds for generalization because of a range of limitations, including small sample sizes and lack of sufficient explanation of the instructional treatment.

The research does not include a theoretical or conceptual framework.

There is a vital need to develop a more integrated, coherent, and sophisticated program of research on distance learning that is based on theory. Theories serve both as goals and tools—as means and ends. As goals, they provide explanations for specific phenomenon with maximal probability. As tools, they provide an underlying framework for observation and discovery by governing the kind of phenomena that investigators study. Theory allows researchers to build on the work of others and, increase the probability of addressing the more significant questions regarding distance learning. Using theory as a guiding framework also allows the research to be replicated and enhances its generalizability, therefore making individual studies more meaningful. Several authors have lamented that there are no theories that deal with the interactions and interrelationships of variables in terms of the effectiveness of distance learning programs.

Do digital libraries provide sufficient and adequate services for the academic programs they are established to support?

The research does not adequately address the effectiveness of digital "libraries."

Students participating in distance learning, particularly those in remote locations, are often introduced to a digital "library" that provides access to bibliographies, as well as full-text, of a variety of resources. The library is at the core of the higher education experience and, especially at the graduate level, is an integral part of the teaching/learning process. Some digital libraries boast an enormous array of resources, with the implicit notion that they can provide the same service as the traditional library. Indeed, digital libraries associated with the University of California, Stanford University, and the University of Michigan have made great advances in providing access to a wealth of collections.

There is some concern, however, that these showcase libraries are not representative of other digital libraries. For instance, is there a tendency for the digital library, because of a limited collection—specifically with respect to copyrighted materials—to adversely affect curricular decisions? Do digital libraries provide adequate services for the academic pro-

grams they are established to support? Anecdotal evidence seems to suggest that the curriculum objectives of some distance learning courses have been altered because of a limited variety of books and journals available from the digital library.

Implications

Research on distance learning has been driven by what many are calling the "information revolution." The rapid evolution and advances in technology offer both the general public and faculty a dizzying array of challenges that are unprecedented. As Wulf stated in 1997 testimony before the U.S. Senate Committee on Labor and Human Resources,

> One of the hardest things for most people to understand is the effect of information technology's exponential rate of improvement. For the last four decades, the speed and storage capacity of computers have doubled every 18-24 months; the cost, size, and power consumption have become smaller at about the same rate. The bandwidth of computer networks has increased a thousand-fold in just the last decade, and the traffic on the network continues to grow at 300-500 percent annually. For the foreseeable future, all of these trends will continue; the basic technology to support their continued advance exists now.[32]

Technology is having, and will continue to have, a profound impact on colleges and universities in America and around the globe. Distance learning, which was once a poor and often unwelcome stepchild within the academic community, is becoming increasingly more visible as a part of the higher education family. But the research and literature reviewed for this paper indicate that the higher education community has a lot to learn regarding how, and in what ways, technology can enhance the teaching/learning process, particularly at a distance.

As with other educational innovations that have come before it, there is some danger that the innovations made possible through distance education are advancing more rapidly than our understanding of its practical uses. Princeton historian Robert Darnton makes this point in a recent essay about electronic publishing. Darnton observes that electronic publishing has passed through three stages since its inception in the 1940s: "an initial phase of utopian enthusiasm, a period of disillusionment, and a new tendency toward pragmatism."[31] In the context of the research on distance learning and its effectiveness, more emphasis has been placed on the "utopian" possibilities of the technology and its potential to do as well as classroom-based instruction. But not enough "pragmatism" has been applied to allow for a discussion of distance learning's practical implications as a supplement to enhance teaching and learning.

There are at least three broad implications that can be derived from this review of the original research and the other literature. The first is that the notion of "access to college" in the distance learning context is unclear. Many of the advocates of distance learning tout access to college-level education as a *raison d'etre* for the proliferation of distance education. Indeed, in some states, public policy leaders are recommending using distance education in lieu of "bricks and mortar" learning. Of particular concern is access as it relates to the efficacy of computer-mediated learning. Unlike two-way interactive video, where students and the instructor can see and talk to each other in a conventional classroom, computer-mediated learning requires special skills of students and more sophisticated technical support if students are to interact fully.

Questions that need to be asked include the following: What is the "quality" of the access? Does the student have the necessary skills to use the technology? What are the best ways to participate in asynchronous communication? Is there adequate technical support? Perhaps most important, will the cost of purchasing a computer and maintaining software be prohibitive for a substantial number of students? Some case studies and descriptive research have addressed these issues; however, as the technology continues to advance, additional research is needed. Access is indeed a hollow concept if students experience insurmountable difficulties that they would not normally encounter on campus.

The notion of "access to college" in the distance learning context is unclear.

Second, it seems clear that technology cannot replace the human factor in higher education. As William Massy notes, "The faculty role will change from being mainly a content expert ('the professor's job is to profess') to a combination of content expert, learning process design expert, and process implementation manager. Faculty also will be motivators and mentors, interpreters (especially of non-codified knowledge), and, as a colleague recently put it, 'expert learners'—people who lead the learning process by breaking the trail and setting the right personal example. Technology can leverage faculty time, but it cannot replace most human contact without significant quality losses."[34]

It seems clear that technology cannot replace the human factor in higher education.

Third, although the ostensible purpose of much of the research is to ascertain how technology affects student learning and student satisfaction, many of the results seem to indicate that technology is not nearly as important as other factors, such as learning tasks, learner characteristics, student motivation, and the instructor. The irony is that the bulk of the research on technology ends up addressing an activity that is fundamental to the academy, namely pedagogy—the art of teaching. To that extent, the research has had a salutary effect in that a rising tide lifts all boats. Any discussion about enhancing the teaching/learning process through technology also has the beneficial effect of improving how students are taught on campus.

Consider this example. In 1987 the American Association of Higher Education (AAHE) published "Seven Principles for Good Practice in Undergraduate Education," which distilled findings from the research on the undergraduate experience. The principles were revived in 1996 to enable those using new communication and information technologies to enhance the teaching/learning process. In one form or another, the principles have been incorporated in a variety of publications on good practice, and were replete in many of the studies.[35]

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AAHE's Principles for Good Practice in Undergraduate Education include those methods that:

- encourage contacts between students and faculty;
- develop reciprocity and cooperation among students;
- use active learning techniques;
- give prompt feedback;
- emphasize time-on-task;
- communicate high expectations; and
- respect diverse talents and ways of learning.

In a sense, the discussion has come full circle. As shown in this paper, the research on distance learning has a long way to go, and much of it is inconclusive. On the other hand, technology has helped the academy to continue its focus on the essential goals of teaching and learning. As a result, either implicitly or explicitly, the key question that needs to be asked is: What is the best way to teach students?

APPENDIX A

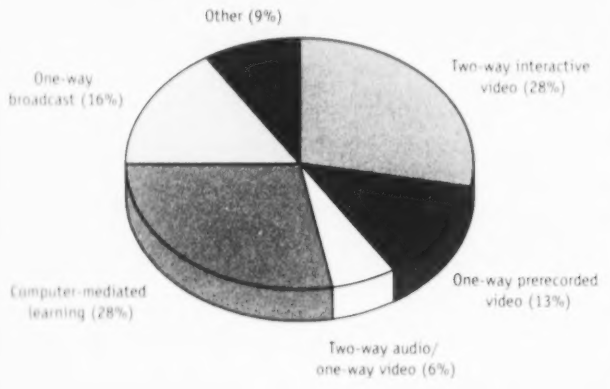
Overview of the Original Research

The following descriptions of the original research on the effectiveness of learning convey a general understanding of the range and variety of studies undertaken. This overview is intended to provide a broad understanding of what the research has examined, the research methodologies used, the academic disciplines studied, and the types of institutions where the research is occurring.

What Technologies Have Been Studied in Distance Learning Research?

One simple way to get a sense of the research on learning is to determine which types of technology are being studied. As noted earlier, distance learning can involve a number of technologies, ranging from two-way interactive video, to two-way audio, to web-based asynchronous communication. As shown in Figure One, about one-quarter of the research studies that were analyzed focused on two-way interactive video, and another quarter targeted computer-mediated learning.[10] Lesser percentages addressed one-way broadcast communication, and one-way prerecorded video. The remaining research articles studied other combinations of technologies.

Figure One: Types of Distance Learning Technology Studied



What Type of Research Designs Are Used to Study Distance Learning?

It is also instructive to understand the types of research designs being used in the study of dis-

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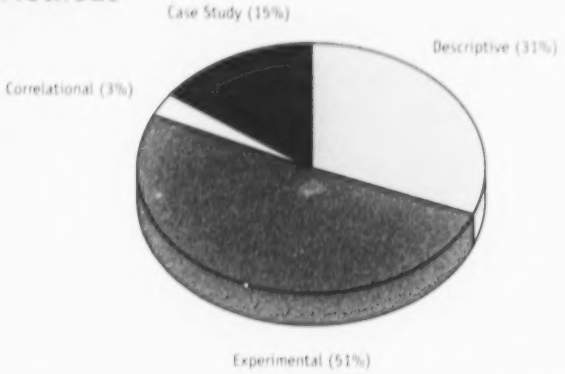
Figure Two: Characterizing Distance Learning Research Studies by Research Methods



tance learning. As shown in Figure Two, more than four out of five of the research designs were either experimental research or descriptive research. Case studies and correlational studies represented only a small proportion of the total.

What Academic Disciplines Are Being Studied?

There is some debate regarding the academic disciplines that are appropriate for distance learning. For instance, given the technology that is available today, it would be difficult to conduct a "public speaking" course using computer-mediated learning. However, the same course could be conducted using two-way interactive video. The more vocal proponents of distance learning insist that virtually any subject matter can be communicated through electronic means, emphasizing the accelerating pace of technology enhancements.

There appears to be a wide variety of academic disciplines under study. Of the studies reviewed, three-quarters focused on undergraduate courses. These data are consistent with the survey results from NCES, where over 60 percent of the distance education courses were undergraduate.[7] At the undergraduate level, traditional liberal arts courses (humanities, social sciences, and math/science) represented almost two-thirds of the disciplines examined. Business and computer science courses represented most of the remaining studies that were reviewed.

Of the relatively few studies that examined graduate courses, there is much less variety. In this group, almost half involved education courses. The remainder included social sciences and, to a lesser extent, nursing, business, and math/science.

Where is the Research Being Conducted?

The vast majority of original research studies was conducted at four-year institutions. Moreover, at these four-year institutions, virtually every type of technology was under study, with two-way interactive video and computer-mediated learning receiving the most emphasis. Of the studies that were reviewed, only two-way interactive video, computer-mediated learning, and one-way broadcast were studied at two-year institutions.

APPENDIX B

Other Articles, Essays, and Research Syntheses

In addition to analyzing original research on the effectiveness of learning, this review also examined articles in major distance learning publications to ascertain the nature of the subjects discussed since 1990. The sources reviewed included: *The Journal of Research on Computing in Education, The American Journal of Distance Education, The Journal of Distance Education, The Journal of Computer Based Instruction, Research in Distance Education,* publications produced by the University of Maryland Institute for Distance Education, publications produced by the American Center for the Study of Distance Education, and *Ed: The Official Publication of the U.S. Distance Learning Association.*

This review of several hundred articles and essays revealed that course and program design for distance learning commanded the most attention in the literature. A significant number of articles addressed issues related to the operational and administrative aspects of providing distance education activities. In general, the articles provided "how to" essays for a variety of technologies and content areas. Many were institution-specific and attempted to identify principles of good practice.

Another prevalent topic in the literature related to the effectiveness of distance education. A number of articles addressed how technologies affected learner outcomes, student satisfaction, and student attitudes toward learning at a distance. The majority of articles provided essays or descriptions regarding the effectiveness of particular technologies at specific institutions. Others identified important variables such as collaboration, interactivity, and learning styles.

A significant number of articles revolved around general research that asked questions such as: What is distance learning? What is the role of distance learning in higher educa-

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tion.' How can distance learning address access and quality? Issues like lifelong learning and the notion of learning anytime and anyplace were explored in relation to distance learning. Several of the articles reviewed past research and provided perspectives from the experiences of individual institutions.

These three areas—course and program design, effectiveness of technology, and general research—comprised the majority of articles in these mainstream distance learning publications. However, student support received considerable attention in many articles. Subjects such as advising and counseling, student records, and financial aid were explored. Commentaries also were found in several journals relating to existing technologies and how they can be better utilized, as well as the potential for emerging technologies.

Subject areas that received the least attention in this review of major distance learning publications were faculty issues and library services. The articles on faculty addressed concerns such as teaching workload, professional development, and technical support for faculty engaged in distance learning. Library issues related to the quality and accessibility of digital libraries.

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5. The reader who has not been exposed to educational research (or has long forgotten it) will find this discussion useful in understanding the array of methodologies used to analyze distance learning. Those with current experience with educational research can skip to the next section. Much of this explanation of types of research is taken from writings of Lorraine Gay, a popular scholar of educational research whose texts are used in many graduate schools across the country. See Lorraine R. Gay, *Educational Research: Competencies for Analysis and Application* (Fifth Ed.), Upper Saddle River, N.J: Prentice-Hall, Inc., 1996.

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